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DANGER IN JUDGING COTTON VARIETIES BY LINT PERCENTAGES.

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DANGER IN JUDGING COTTON VARIETIES BY LINT PERCENTAGES.

INTRODUCTION.

Many instances might be collected to show how injudicious selection can work injury to domesticated varieties of animals and plants. Too persistent attention to a single character or standard often results in the neglect of other indispensable qualities whose importance may remain unconsidered until some serious deficiency is revealed. Thus the coffee planter who selects for large seeds without reference to other characters soon finds that he has increased the proportion of loose and irregular "beans," for these are frequently larger than any of the normal seeds.

True improvements of varieties involve the preservation of high standards in many directions at once. It may be allowable to specialize on one desirable feature or another, but none of the essentials can be safely left out of account. The use of lint percentages as one of the primary standards in the selection of cotton varieties, and often as the single standard, is one of these dangerous tendencies which is likely to lead to injury rather than to improvement if caution and discrimination are not learned from an appreciation of other factors.

The danger of laying too much emphasis upon the percentage of lint is greatly increased by the practice common in some parts of the South of selling the seed cotton on the basis of the percentage of lint found in a tested sample of the crop. No scientific breeder would hold that selection should be based on lint percentages alone, but if the lint percentage continues to appear as the chief issue in the minds of the farmer and of the commercial seed dealer much unintentional damage may be done. Inferior and unproductive varieties are likely to be planted if they have high percentages and actually superior varieties refused merely because their percentages are lower. Thus it has been reported by Mr. William A. Orton that an

improved variety of Sea Island cotton (Rivers), specially selected and distributed by the Bureau of Plant Industry of the United States Department of Agriculture, has failed to become popular because the lint percentage is slightly lower than in some other varieties, though in actual yield of lint it "compares favorably with any other."[a]

It would be a serious misfortune if the buying and selling of unginned cotton on the basis of lint percentage should be the cause of extending this mistaken idea that lint percentage is all-important. Some of the States prohibit the sale of unginned cotton as a means of protecting farmers against thieves, but the method of buying by lint percentage is in itself neither unjust nor inconvenient. It is essential, however, that the farmer, as well as the seedsman and the breeder, shall understand that lint percentages are being connected with two entirely separate problems. The use of the lint percentage to figure out the value of the commodity has nothing to do with the way the lint percentage should be used in determining the value of a variety. After the crop is ripe and the price is agreed upon the percentage of lint determines what the farmer's returns shall be. This is the commercial problem. The agricultural problem comes before the crop is planted. It is to choose the variety which will give the most valuable product. Here the lint percentage is only one of several factors, for the highest percentage of lint does not insure the largest or the most valuable crop.

The need of improving cotton varieties and methods of culture is appreciated now as never before, with the high prices of the fiber and the difficulty of securing labor to produce it. Planter and buyer alike are interested in improving the quality and increasing the yields. The time must soon come when intelligent farmers will carefully select their own seed, for experiments are showing that larger yields and better staple can generally be secured in this way than by the frequent change of varieties, however promising the new stocks may have appeared in the place where they were bred. This makes it all the more important that farmers should not imagine that attention to lint percentages alone affords any assurance that a variety is being improved or that a new sort is superior to the best that their own neighborhood affords.

The local adjustment of cotton varieties is a matter of much greater practical importance than is generally supposed. Different conditions result in notable changes in the behavior of the plants. Even a superior variety may show a serious deterioration when planted for the first time in a new place. Improvements in yield ranging between 10 and 20 per cent have been found in the second

[a] Orton, W. A. Sea Island Cotton, Farmers' Bulletin 302, U. S. Dept. of Agriculture, p. 46. 1907.

generation over the adjacent rows representing the same stock planted in the new place for the first time.

The invasion of the boll weevil is leading to many changes in the methods of culture of cotton, and corresponding modifications of the standards of breeding are also required. It is therefore especially important at this time to consider all the factors that bear upon the question of improvement.

SMALLER OR LIGHTER SEEDS RAISE LINT PERCENTAGE.

In using lint percentages for commercial purposes the size of the seed does not need to be considered, for the object is merely to calculate the amount of lint in a given quantity of seed cotton. When the lint percentage is used agriculturally as a basis for estimating the productiveness of a variety the size of the seed must be taken into account, for the same percentage with a large seed means more fiber for the same number of seeds.

If all cotton plants produced an equal number of seeds of the same size and weight the percentage of lint would be an index of the productiveness of a variety, but it is not safe to rely upon any such assumed equality, for the numbers, sizes, and weights of seeds are extremely variable factors which change the significance of the percentage. High percentages may accompany low yields or may result from small seeds.

Smaller or lighter seeds increase the percentage of lint quite as effectively as an additional amount of fiber. Larger seeds, on the contrary, reduce the percentage of lint in spite of the fact that the actual amount of lint in the boll may not be reduced. Reduction of the size of the seed raises the percentage of lint even though the fibers do not become any longer and are not set any closer together. The area of the surface of the seed does not decline as rapidly as the weight of the seed. The surface is reduced in proportion to the square root of the diameter, the weight in proportion to the cube root.

To increase the lint-bearing surface of a cotton seed by 3 per cent would involve an increase in weight of about 30 per cent. The percentage of increase of weight in the seed altogether outruns the increase in percentage of lint, and makes the *percentage* of lint smaller in spite of an increase in the *amount* of lint. Thus, if in a variety having 33 per cent of lint the weight of the seed were increased by one-third the lint percentage would fall to about 26, even though the amount of lint were increased by 3 per cent, to correspond with the larger surface.

Instances where the lint percentages show a notable decrease in spite of actual additions to the amount of lint are very common in

hybrids between cottons of the Sea Island type and some of the Mexican and Central American representatives of the Upland series. A Mexican cotton with 27 per cent of lint hybridized by Egyptian cotton having a somewhat higher percentage gave a progeny with a percentage of only 22.9, although the lint increased in weight from 4.05 grams to 4.45 grams per hundred seeds. This addition to the lint was greatly outweighed, however, by the enlargement of the seeds from 10.95 to 14.75 grams per hundred. To make sure that a higher lint percentage is accompanied by an increased amount of lint it is necessary to know that the weight of the seeds has not declined, either by reduction in size or by change of texture or compactness.

ADVANTAGE OF LARGE SEEDS AND LARGE-SEEDED VARIETIES.

The size of the seed is a question of practical importance apart from the question of lint. In former decades small seeds would have appeared preferable, at least as a means of reducing the expense of picking and handling. The increasing demand for cotton seed for oil and other uses tends to reduce this preference for small seeds. During the last season cotton seed was nearly worth the picking, even without the lint. The prices of cotton seed need not go much higher before large-seeded varieties will be directly preferred.

The presence of the boll weevil gives large seeds a definite advantage, since they contribute to the prompt development of the cotton by giving the young plant a better start. The stronger the young plant is at the time of germination the greater are its chances of breaking through the crust of sun-baked earth which weak seedlings are often unable to penetrate. Small-seeded varieties, like the Peterkin, sometimes fail to come up, while large-seeded types, like the Russell, may show a good stand under the same conditions. An instance is related by Mr. L. H. Dewey, of the Bureau of Plant Industry, of a planter who selected his cotton for high lint percentage and small seed until the seedlings were too weak to come up.

After germination the ability of the young seedlings to make continuous growth must still depend considerably upon their size and the amount of stored nutriment contained in their tissues. The faster they grow at first the farther their roots will reach down into the moist soil and the less becomes the danger of being dried up or broken down by the wind. The more vigorous the seedlings the earlier the varieties should be, if other things are equal.

Some of the early varieties, like the King, have small seeds, as they also have small bolls and short lint. The planting of such varieties has been advocated in boll weevil districts as a means of securing early crops. Nevertheless, it has to be considered that this form of earliness, secured by reducing the size and thus shortening the period

of development, may afford no better protection against the weevils than can be obtained in some of the large-seeded big-boll varieties.

Early opening of the bolls is not the best index of the amount of protection obtained by early development. Long before the bolls are mature they are beyond the reach of weevil injury. A variety which sets a crop of bolls early and carries them past the danger of weevil infection may produce a larger crop in the presence of the weevils than the variety which ripens the first bolls. Some of the Central American varieties of cotton retain the mature bolls for long periods and do not open them until dry weather comes. The ideal habit of earliness would be met by a variety which could develop a large number of bolls past the point of weevil injury early in the season. Delay in the date of opening might be an advantage if all the bolls would open together and thus avoid the need of making several pickings of the same field.

This plan of developing weevil resistance in big-boll cottons is worthy of careful consideration for the further reason that it avoids the injury to the industry which is involved in extending the cultivation of the small-seeded, short-staple varieties on the ground of earliness. Misapprehension regarding the importance of lint percentages tends to conceal the true value of desirable big-boll varieties, both those now known in Texas and the other more definitely weevil-resistant types now being introduced and acclimatized from Mexico and Central America. The big-boll varieties also have large seeds, so that the lint percentages do not represent their true value in comparison with small-seeded varieties. This should not be taken to mean that the big-boll varieties have lower percentages than other types, for both the Texan and the Central American big-boll types often show very high percentages. The point is that a high percentage in a large-seeded big-boll cotton should mean more, even as a percentage, than in a small-seeded small-bolled variety. For the reasons already indicated, the lint has to be relatively more abundant in a large-seeded variety to indicate even the same percentage as in a small-seeded variety.

Thus it appears that too much reliance upon lint percentages as a standard for judging varieties has tended to keep us from fully appreciating the value of the big-boll varieties. In Texas, at least, the inadequate supply of labor makes the large bolls a very desirable feature, for the cotton can be picked much more readily and cheaply. Pickers are often willing to gather big-boll cotton at a lower price than the small-boll varieties, for the difference in the size of the bolls makes considerable difference in the proceeds of a day's labor. When labor is scarce the farmers who are unwilling to pay a higher price for picking small-boll varieties sometimes leave their cotton ungathered in the fields.

ADVANTAGES OF HEAVY SEEDS.

That cotton is no exception to other crops in the superiority of firm, heavy seeds has been demonstrated by a series of experiments made by Dr. H. J. Webber and Mr. E. B. Boykin, of the Bureau of Plant Industry, in South Carolina. The heavy seeds planted separately gave crops about 10 per cent greater than the light seeds. In Upland cotton the fuzz interferes with the separation of the light and heavy seed by winnowing, but it was found that this could be obviated by rolling the seeds in a revolving drum with small quantities of paste, to stick the fuzz together and render the seeds easily separable.[a]

Deterioration in the texture, weight, and vitality of the seeds is one of the frequent symptoms of degeneracy in plants. The seeds are the young plants themselves. By weighing and other tests of the seeds we can learn in advance whether the inclosed plants are healthy and vigorous or malformed and puny. The vigor of the seed is of much more importance in a field crop than in garden plants which can be given special protection in their earlier stages. The seeds of cotton plants in particular are unusually subject to injury and deterioration, and the young seedlings are very delicate, as the farmer learns from the frequent need of replanting. The seed coats are not very strong. As in many other tropical plants the embryo of cotton is very large and is only loosely rolled up, quite unlike the seeds of most of the species native in the Temperate Zone. Unless the seed is sheltered and kept dry freezing readily kills it.

HIGHER LINT PERCENTAGES WITH DIMINISHED FERTILITY.

If two cotton plants bear the same number of bolls containing the same number of seeds, the plant with the higher percentage of lint might still produce less cotton than the other. The lint percentage does not express an absolute fact, but shows only a relation between the lint and the seed which may or may not be an indication of greater fertility. Even though the seeds were large and the lint percentage still remained high, the number of bolls might be reduced and thus counteract the advantage of the increased amount of lint on the individual seeds. Lint percentages can not be substituted for actual tests of yield.

When the productiveness of a variety or strain of cotton has been fairly and thoroughly tested, these results must replace any opinions that may have been formed from lint percentages. There is no virtue at all in lint percentage standing alone. Attention to lint percentages serves only to avoid one form of deterioration, as a partial substitute

[a] Webber, H. J., and Boykin, E. B. The Advantages of Planting Heavy Cotton Seed, Farmers' Bulletin 285, U. S. Department of Agriculture. 1907.

for tests of yield, and even then they may be misleading unless the weight of the seed is also taken into account.

To secure higher percentages of lint on seeds of the same size and weight means that the fibers have to be longer, or coarser, or closer together. Experiments have shown that longer lint means, almost invariably, reduced percentages. Coarser lint is not desired, so that the crowding of the lint closer together would be the real object of selection for higher percentages. But whatever the character upon which selections are based, narrow breeding to secure very high degrees of expression of particular characters carries with it the general result of diminished fertility.

To reduce the fertility of a variety by careful selection for high percentages would be in accord with the usual result of diminished fertility in highly specialized, narrowly selected types. Selection by lint percentages instead of increasing the agricultural value of a variety might actually diminish it. The value of the variety might go steadily downward while the lint percentage was advancing. Thus, higher percentages of lint are not only unreliable as indications of increased production but might even accompany declining yields in degenerating varieties.

If the selection began with a variety having a tendency to larger amounts of lint, selection might be followed by a further increase of the character, but a careful and persistent selection might be expected to bring the other factors of small or light seed and reduced fertility into operation. Domesticated varieties usually degenerate much more readily than they advance to higher standards. To specialize our varieties of field crops in characters which have no practical importance is not only a waste of effort but may actually injure them.

LARGE YIELDS WITHOUT HIGH PERCENTAGES.

It might be argued that plants could produce more seeds if the seeds were smaller and that more lint could be secured from varieties with smaller seeds and higher percentages. It is true that the same amount of seed material made up into small seeds would produce more lint-bearing surface than if made up into larger seeds. It does not follow, however, that this method of increasing the lint accords with the physiological economy of the plant. As yet we have no evidence that varieties can be improved in yield by reducing the seeds and thus securing the higher percentages that result from the smaller size.

That there is no necessary connection between lint percentages and yields is shown by the fact that very high yields are obtained from varieties with relatively low percentages of lint. In Sea Island and Egyptian cottons the percentages fall below those reached in some of our Upland varieties, but high yields are not prevented by

lower percentages of lint. It is well known that the yields of cotton obtained in Egypt range distinctly higher than in the United States.

Similar results have now been obtained in experiments with Egyptian cotton in the United States conducted by Mr. T. H. Kearney, of the Bureau of Plant Industry. After several years of acclimatization and selection at Yuma, Ariz., the Egyptian cotton is showing its normal fertility. It yielded in 1907 at the rate of 3,330 pounds of seed cotton per acre, more than any of the Upland varieties included in the test. The yield of lint was slightly exceeded by one of the Upland varieties, but the value of the lint of the Egyptian cotton was much greater than that of the Upland.

The results of many tests of Upland varieties at the experiment stations of several of the Southern States have been tabulated by Mr. Fred. J. Tyler, of the Bureau of Plant Industry, who finds that the highest yields are secured from varieties with the higher percentages of lint, as might be expected from the fact that the improved varieties have generally been selected with reference to the percentage of lint. At the same time it is evident from the figures that there is no very direct or necessary relation between lint percentage and yield, for some of the notably prolific varieties show only moderately high percentages of lint. Thus, the Russell variety has an excellent reputation as a yielder of large crops of lint, though its percentage is only 32.

Another even more striking instance has come to light in a recently published report of the Department of Agriculture of North Carolina. The results of tests of 27 varieties are tabulated separately with reference to several different factors. The variety which gave the best returns for the farmer and was first in actual amount of lint stood as No. 13 in percentage of lint. The variety with the highest percentage of lint stood as No. 20 in yield of lint and in agricultural value. The high percentage of lint was not connected with greater fertility, but was evidently a consequence of the small size of seeds. The variety which produced the most lint ranked as No. 3 in size of seeds, while the variety with the highest lint percentage fell to No. 23 in size of seed; finally, it was the latest in ripening of the whole series of varieties.[a]

Other things being equal, the high-percentage varieties would always yield more lint, but it is evident that the other things are often unequal and that the high percentages have no fixed connection with vigor and fertility. Lint percentage is important as long as the other features are not left out of account, but persistent selection for lint percentage alone would be as likely to reduce the crop as to increase it.

[a] Bulletin of the North Carolina Department of Agriculture, vol. 29, No. 2, p. 47, February, 1908.

HIGH QUALITY WITH LOW PERCENTAGES.

If high-lint percentages do not insure high yields, much less do they insure high quality. With longer lint the percentage might be expected to rise, but the change is almost invariably in the opposite direction. In spite of the greater length, the percentage falls rapidly as the lint of carefully selected varieties becomes longer.

Longer lint, even in Upland varieties, is usually accompanied by a deficiency of fuzz, as though the long lint were being attained by an approach to the characters of the Sea Island and Egyptian types, where the seeds are left smooth and naked after the lint is removed. As the fuzz is weighed with the seed the absence of fuzz reduces the weight of the seed and tends to increase the percentage of lint. Nevertheless, the rule is that the lint percentage declines with every increase in the length of lint and smoothness of seed.

Differences in the sizes of the seeds would affect these results and would have to be taken into account in any effort to determine the true relation of the reduced percentage to the actual yield of lint. If the seeds were becoming larger, the reduced percentage of lint might not involve a reduction in yield, while if the seeds were becoming smaller, the yield might decline even more rapidly than the percentage would indicate.

Very high quality and very high percentages being apparently incompatible characters, the raising of percentages must be recognized as a secondary consideration when high quality is seriously desired. With sufficient differences in price, low percentages of lint, even if they involve smaller crops, may still leave an advantage for the farmer. High grades of cotton are more than ever in demand. The time must soon come when the question of quality will secure more careful consideration in all parts of the cotton belt.

It is true that there are still many districts where the individual farmer can secure little or no advantage from improving the quality of his crop. The local buyer may refuse to pay a higher price to individual farmers who grow better staples, especially if only a few bales are to be had and the locality is not known in the trade as producing a superior quality of cotton. Concerted action in a whole community or district is as important in the choice of varieties as in the application of measures of protection against the boll weevil. If some of the farmers carelessly continue the planting of inferior varieties the whole district suffers, just as careless farmers may keep their neighbors supplied with boll weevils instead of contributing an honest share of effort toward mitigating the pest. Associations of cotton planters are giving such matters their attention, the importance of concerted action being more and more appreciated.

TRUE STANDARD OF YIELD IN COTTON.

The fact which would give the most direct indication of productiveness is not the proportion between the lint and the seed, but the proportion of the lint to the plant as a whole. Comparison of the weight of the lint with the weight of the plant would determine how much in the way of other tissues the plant has formed in producing a given amount of lint. It shows how efficient the plant is in producing lint. Such percentages of lint to dry weight of whole plants are not always easy to secure, because many of the leaves may fall before all of the bolls are mature. Even without weighing the plants it is possible by mere inspection in the field to judge something of their productive efficiency.

The total yield of the individual plant is not a completely satisfactory index of the productiveness of the variety under field conditions if the plants are disproportionately large. The yield per acre may not be increased by larger individual production if the number of plants is reduced. No method of judging individual plants can be accepted as a complete substitute for actual field tests.

There should be no discrimination against small plants if they are fertile in proportion to their size. If plants are small they can grow closer together. Small plants have a distinct advantage in weevil resistance, for they can mature a larger proportion of the crop early in the season, before the weevils become sufficiently numerous to prevent the development of the buds and bolls.

Prompt production often has another advantage in the drier regions of the Southwestern States, where cotton cultivation is now making rapid advances, partly because of the prevailing high prices of cotton and partly because the boll weevil does less damage than in the humid regions nearer to the Gulf of Mexico. A small early type of cotton may be able to make prompt use of the available supply of water in the soil and thus mature a crop, whereas a large late variety may fail through drought to reach a productive maturity.

A LINT INDEX FOR JUDGING VARIETIES.

Since the lint percentage alone is not a suitable standard for judging varieties, the question naturally arises whether any other standard would better serve the purposes for which the lint percentage is now employed. In the work of securing improved strains of cotton by selection it is very important that the breeder have as good a means as possible of judging in advance whether the plants that appear desirable in other respects can also be expected to excel in productiveness.

It is commonly recognized that the yields of individual plants, single rows, or small plots are not trustworthy indications of out-turn

in the field, and it is often supposed that the lint percentage represents something more definite and reliable. Having recognized the danger that high lint percentages are likely to be accompanied by small seeds and small bolls, we must seek the most practicable means of avoiding these dangers by basing our judgment on some less equivocal standard. Though nothing short of actual field tests will determine the productiveness of a variety and its adaptation to local conditions, it is entirely possible to avoid some of the uncertainties of lint percentages by using as a *lint index* the weight of the lint itself instead of the less important proportion between the lint and the seeds.

The lint from 100 seeds of Upland cottons ranges in weight from 6 grams or less to 9 grams and upward, and these figures can be directly applied as a standard in judging varieties in place of the lint percentages. A lint index on this basis would mean something actually accomplished. The unintentional discrimination in favor of small seeds and small bolls would be avoided. The lint index would give the breeder a far better assurance of superiority than the percentage could ever afford. Reducing the size or weight of the seed would no longer give a variety the misleading advantage that it does by increasing the lint percentage. The chances are fair that the largest amounts of lint will be found on seeds of large size, if not on the largest. At the same time large seeds would not be admitted if the amount of lint were small.

The relation between large seeds and large amounts of lint (high lint index) has been tested by Mr. D. N. Shoemaker, of the Bureau of Plant Industry, by a study of weights of seeds and lint in a series of selections of Triumph cotton. This variety is very well adapted for such study because it represents one of the most uniform types of Upland cotton.

The weights of 73 samples were used for comparison. The average weight of 100 seeds was 12.37 grams, and the average weight of lint of 100 seeds was 7.38 grams. Of 44 plants whose lint was above the average only 4 plants fell below the average in weight of seed. Similarly, of 29 plants which fell below the average in weight of lint only 4 were above the average in weight of seed and these exceeded the average only a little. No such evidence of correlation was found when the same data were arranged with reference to size of seed and percentage of lint. Of the 28 plants which showed lint percentages above the average of 37.7, about half (15) had seeds below the average weight, while the other 13 had seeds above the average.

The selection of the plant with the highest percentage of lint (42.8) would have meant the rejection of no less than 41 plants whose seeds produced larger amounts of lint. In other words, the plant with the

highest percentage would have ranked as number 42 in the series of 73 plants if arranged by lint indexes. The plant with the highest percentage of lint really had only seven-eighths as much lint on its seeds as the plant that showed the highest lint index. This serves to indicate the extent of the practical difference in this variety between the lint index and the lint percentage as the basis of selection. If all the plants were like that with the largest percentage of lint, the crop would be one-eighth smaller than if they were all like that with the highest lint index, provided, of course, that both produced the same numbers of seeds.

The only objection to the use of lint indexes instead of the lint percentages is that the labor of determining the indexes is somewhat greater, though it is no more than would always be required to avoid the danger of preferring inferior stocks because of high percentages. The counting and weighing of 100 seeds after ginning is a simple matter. The additional difficulty would come in counting seeds while the lint is still on them, and then in ginning these small quantities separately and at the same time with sufficient accuracy to make the results of value.

The lint percentage affords a means of avoiding this difficulty without lessening the accuracy of the results, for the weight of the fiber of 100 seeds can easily be calculated after the weight of the seeds and the lint percentage are known. The weight of the hundred seeds divided by the percentage of seed gives the weight of the hundred seeds before ginning. Subtracting the weight of the ginned seeds gives the lint index or weight of the lint of the hundred seeds. With a slide rule it is easier to multiply the weight of the seed by the lint percentage and then divide by the percentage of seed.

The lint percentage is made more reliable by using large samples the seeds of which do not need to be counted, for the percentage is a matter of weight alone. Thus the percentage still remains of use to the breeder, though no longer employed by itself as a standard for judging varieties. The index has a direct relation to the size of the seed which the percentage alone does not have.

Lint indexes determined in this way can be still further corrected or combined with the results of other tests of productiveness, such as the amount of lint from 10 bolls or the amount of lint yielded by a whole plant. Nevertheless, there is not the same need of such corrections as when the percentage was used directly as a standard. The number of seeds in a lock of cotton appears to be much more constant than the number of locks in a boll, so that 10-boll samples are likely to be much more subject to variation than the lint indexes unless care be taken or allowances made for differences in the number of locks and in the number of seeds in the locks.

The following table illustrates the range of diversity of lint indexes and percentages in different varieties and types of cotton. The last two columns show the differences of rank which result from the substitution of the lint index for the lint percentage.

TABLE I.—*Examples of lint indexes of different varieties of cotton compared with lint percentages.*

Weight of 100 seeds.	Lint index (weight of lint of 100 seeds).	Lint percentage (ratio of lint to seed cotton.)	Rank by weight of seed.	Rank by index.	Rank by percentage.
Grams.	*Grams.*	*Per cent.*			
19.38	11.33	36.9	1	1	6
13.38	9.14	40.6	7	2	2
13.12	8.22	38.5	8	3	4
13.97	8.00	36.4	6	4	7
10.00	7.50	42.8	14	5	1
11.26	7.28	39.3	13	6	3
14.24	7.24	33.7	5	7	10
11.62	6.36	35.4	12	8	8
16.10	5.89	26.8	3	9	15
18.20	5.43	23.0	2	10	17
8.31	5.17	38.3	19	11	5
11.58	5.13	30.7	11	12	14
9.69	4.90	33.6	15	13	11
7.61	4.16	35.3	20	14	9
14.62	4.00	21.5	4	15	18
8.92	3.96	30.8	17	16	13
8.35	3.84	31.5	18	17	12
12.92	3.49	21.3	9	18	19
9.53	3.09	24.5	16	19	16
12.53	2.23	15.1	10	20	23
6.06	1.39	18.6	21	21	20
4.97	1.11	18.3	22	22	21
4.23	.81	16.1	23	23	22

CONCLUSIONS.

The current opinion that a higher percentage of lint proves the superiority of a variety of cotton is a dangerous error, more likely to lead to the deterioration of cotton varieties than to improvement. High lint percentages give no assurance of large yields or of high quality, but may result from smaller or lighter seeds and may characterize weak or unproductive varieties. Other features which bring increased productiveness or higher quality may more than compensate for lower lint percentages and should have the impartial consideration of the farmer and breeder.

The fact that lint percentages are used by buyers to estimate the amount of lint in a crop of cotton affords no reason why the farmer or the breeder should consider the lint percentage as the chief requirement. The custom of selling cotton by percentage of lint should not establish in the mind of the farmer the idea that the lint percentage is a true standard for judging varieties for planting. The agricultural question of how to produce the most fiber to the acre is entirely separate from the commercial question of calculating the amount of lint in the crop after the seed cotton has been harvested.

The farmer and the breeder must consider the lint percentages in relation to other factors of practical importance. The size and vigor of the seeds must be taken into account, as well as the fertility of the variety and the length and quality of the fiber. It is only when these other qualities are maintained that higher lint percentages can be accepted as evidence of the superiority of a variety or specially selected strain of cotton.

Superiority in the one factor of lint percentage must not be purchased at the expense of quality, productiveness, or early maturity. It would not be wise to select for any of these factors alone and neglect the others, nor is it wise to select by lint percentages alone. Persistent narrow selection directed to any one feature like the percentage of lint would be more likely to injure than to benefit a variety, however much the variety may appear to improve as long as the lint percentage is accepted as the sole standard of excellence.

On the other hand, it need not be supposed that lint percentages are of no value because they are not as significant as often supposed. Though not a question of primary importance, like quality and yield, the lint percentage is one of the factors of fertility which should not be left out of account. Individual cotton plants of the same variety may be expected to differ as much in percentages of lint as in other respects, and there is every reason to suppose that larger yields can be obtained by selection for higher percentages of lint if other factors of fertility and value are not left out of account. The safest and most effective way of using lint percentages for agricultural and breeding purposes is for determining a lint index, representing the amount of lint produced by 100 seeds. Such indexes afford much more reliable standards for judging varieties than the lint percentages used alone.

Without going to the other extreme of attempting to develop low-percentage varieties, farmers and breeders should avoid limiting selection to individuals or to varieties with high percentages unless they have carefully assured themselves that the other desirable qualities, such as large seeds and large bolls, are not declining. Other things being equal, a decline in these features would be more likely than an improvement if selection were limited to the one feature of lint percentages.

Approved:

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